Level of Behaviour Change Achievable by Handwashing with Soap Interventions: A rapid review

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Report Summary

Evidence on Demand was requested by DFID to undertake a rapid desk-based study to assess the level of change in handwashing with soap that could be expected from a successful hygiene promotion intervention in a low or middle-income country setting. As part of this task, a summary of factors that may influence intervention outcomes and sustainability is provided.

The objective of the review was to identify the level of behaviour change, in this case handwashing with soap, the various interventions were able to achieve. This review focussed on published peer-reviewed articles as well as programme reports and other grey literature providing evidence of behaviour change. The authors primarily reviewed mainstream research published in the last 10 years. In order to be included in the review, the manuscript or report needed to include information on an intervention to promote handwashing with soap, or an evaluation thereof, be delivered in a low or middle income country, be available in English and preferably have a behaviour outcome or a health outcome with considerable data on behaviour.

Only eight successful interventions were included as part of this review. These comprise of both large-scale and smaller-focussed interventions, in various settings, using different approaches. These interventions have shown that achievable handwashing behaviour change ranges between 14%-67% increases in handwashing behaviour as measured by observation (sustained changes—45 day to 18 months) and between 4%-46% as measured by self-report (post intervention and continuous assessment). Measures of sustainability of interventions are limited; one intervention showed sustained behaviour up to 45 days, and data from two interventions show that change in behaviour was sustained for at least 12 months. One intervention has been assessed after five years, and still shows evidence of the sustained behaviour.

All interventions provided data on handwashing at key times, and the majority measured handwashing through observation with only one using only self-report. Most interventions used multiple methods. Spot checks of facilities and handwashing demonstrations were additional proxy measures used in some of the reviewed interventions.

In two of the interventions, soap for handwashing was provided as part of the intervention and in all the interventions soap use was mentioned. Water availability was limited in three of the eight included interventions.

It was found that handwashing reminders, such as stickers with eyes at the designated handwashing facility, can be used to prompt handwashing behaviour. In addition, knowledge of key handwashing times, or good handwashing ‘technique’ does not necessarily translate into handwashing habit, nor does the provision of a handwashing facility automatically translate into use.

Due to the wide variation in setting and context in which the eight interventions were implemented, the results cannot be directly compared to draw out ‘best approaches’. In addition, the interventions included measure a range of handwashing behaviours, for example after visiting a toilet or before eating—these different measures are likely to have varied effects of the levels of behaviour change observed, and thus makes direct comparison difficult. However, the majority of included interventions considered underlying theories of behaviour change. Overall, key factors which may contribute towards a

successful behaviour change intervention include extensive formative research to understand the target population, duration of follow up (as well as number of follow up points) after intervention, baseline levels of handwashing behaviour and the key handwashing times which are targeted. Overall, this area of research would benefit from for rigorous impact and process evaluation, subsequent modification of intervention design, and further testing of 'new generation' handwashing with soap interventions. In addition, evidence of cost would be beneficial, as this would help determine which successful interventions can also be implemented in a cost-effective manner.

Section one of this report provides a background to the challenge of behaviour change and the methodology used for the rapid review.

Section two sets out the key findings of the successful interventions.

Section three presents factors which may have led to the success of the intervention and provides implications for programming. Case studies highlighting specific factors in different approaches are included.

An annotated bibliography, as well as a full list of references is provided.

SECTION 1

Introduction

1.1 Purpose of the review

Evidence on Demand was requested by DFID to undertake a rapid desk-based study to assess the level of change in handwashing with soap that could be expected to result from a successful hygiene promotion intervention in a low or middle-income country setting. As part of this task, factors that may influence intervention outcomes and sustainability were also reviewed.

1.2 Background on handwashing promotion

Handwashing with soap has been suggested to be the most cost-effective way of reducing the global infectious disease burden (Jamieson et al. 2006), with the potential to reduce morbidity and mortality from several major infectious illnesses, including diarrhoeal (Curtis et al. 2003; Ejemot et al. 2008) and respiratory diseases (Luby et al. 2005; Rabie et al. 2006; Aiello et al. 2008). However, handwashing with soap is rarely practiced in homes at times when it is generally agreed that it could effectively interrupt transmission of disease. These times include: after risk of contact with faecal matter (defecation or cleaning a child) and before handling food (food preparation, feeding a child or eating) (Curtis et al. 2009; Freeman et al. 2014). Despite decades of implementation and research in low-income settings together with important advances in knowledge about the drivers of behaviour (for example, Curtis et al. 2009; Curtis et al. 2011), there is still limited evidence on what works. For example, data on which intervention strategies are most likely to lead to the adoption of good handwashing habits and when hands need to be washed to derive the maximum benefit is lacking (Curtis et al. 2011; Luby et al. 2011).

Changing behaviour—in this case handwashing with soap—includes efforts to encourage and persuade the target population to adopt new behaviours. Such efforts may include education, community mobilisation or social marketing[1]. Different channels of communication can be used, including mass media, via institutions such as schools and clinics, community events such as theatre as well as direct person to person via household visits. Many interventions use several channels, and the size of the target population helps determine which approach may be most suitable. At the household level, for example, education may focus mainly on the individual and rely on communicating 'facts' related to disease transmission and prevention. It aims to alter the perceptions of risk, provide information on the best ways to mitigate disease risks and encourages the individual to take charge of their own well-being. Community mobilisation builds on education by adding social support, as well as social pressure or social norms. As such, it targets the community as a whole rather than only the individual. Marketing aims to change the value attached to the encouraged behaviour, for example through highlighting non-functional benefits or reducing

[1] Though various definitions of social marketing exist, broadly, social marketing seeks to develop and integrate marketing concepts with other approaches to influence behaviours that benefit individuals and communities for the greater social good.

A good introductory resource on social marketing has been developed by the World Bank and can be downloaded at https://openknowledge.worldbank.org/handle/10986/17352

the costs (money, social, transaction) of taking up the new behaviour. Many interventions combine a range of activities to try and change behaviour at various 'levels', including: provider training, community-based outreach, community mobilisation, social marketing, mass media advertising, Enter-Educate (e.g. street theatre) and community-wide, multiple component programmes (Valente 2002).

Many programmes with behaviour change goals are now preceded by formative research, which involves trying to understand why people behave as they do as a way of determining how best to encourage them to change their behaviour in the resulting intervention (Curtis 1997). In addition, in recent years considerable experience in handwashing promotion has been gained by working with, and learning from the private sector—for example commercial soap manufacturers (Curtis 2010). Understanding consumer motivation, employing a single unifying idea, planning for effective reach and ensuring effectiveness of the intervention before scale up are all lessons which can be learned from commercial marketers (Curtis et al.2007).

1.3 Assessing change in handwashing practices due to interventions

Assessing changes in handwashing practices due to interventions is challenging for a number of reasons: i) The actual measurement of handwashing practice is difficult; ii) Handwashing is not one single behaviour but a variety of different behaviours that take place at different times of day by different people, with regular or irregular patterns. There is little evidence as to which handwash events (i.e. at which times) are critical for health; iii) Interventions vary substantially in approach as well as intensity, and; iv) Whilst there are a reasonable number of studies that reported the impact of a handwashing intervention on health, few have reported the impact on behaviour, hence the intervention-behaviour link is poorly characterised. Nevertheless, collating what we do know about this issue is an important task for public health so that we can better understand how to intervene, and so that we can better model health benefits and relative cost-effectiveness of the intervention. As such, the purpose of this review is to determine the level of change in handwashing with soap that could be expected to result from a successful hygiene promotion intervention in a low or middle-income country setting.

1.4 How do we measure handwashing?

Measuring handwashing with soap is challenging for a number of reasons. For example, defecation and post-defecation hygiene practices usually take place in private and asking about people's habits can be culturally sensitive and cause offense. In addition, handwashing takes place irregularly and soap use for handwashing is often not consistent (Curtis et al. 2009). Handwashing can be measured directly by self-report or structured observation. Additional methods include indirect measures using proxies of behaviour, such as rapid assessments or 'spot checks' of hands or facilities, or less commonly, using microbiological measures of hand contamination or sensor technology (Cousens et al. 1996; Biran et al. 2008; Ram 2013). Each approach has benefits and limitations (Ram 2013).

Self-reported data is often collected using a questionnaire as this is the easiest way to rapidly collect information on handwashing practices. However, individuals regularly report better handwashing behaviour than they display during observation—this exaggeration may result from a perceived high social desirability of handwashing (Manun'Ebo et al. 1997; Ram 2013). Structured observation records actual handwashing behaviour and is a more objective indicator, but it is labour-intensive, costly and can induce reactivity (changes in handwashing due to the presence of an observer) (Bentley et al. 1994; Arnold et al. 2015). Although not suitable as the primary outcome measure in large-scale evaluations and

despite the drawbacks, structured observation is still considered the most valid method available for measuring handwashing practices (Ram 2013).

Rapid observation or spot checks include the collection of data on 'proxy' measures for handwashing. For example, observations on the presence of soap and water at the usual handwashing location, or assessing cleanliness of hands may provide an indication of poor handwashing behaviour (Biran et al. 2008; Luby et al. 2011). However, a recent study showed that even in the absence of intervention or promotion activities, reactivity induced by repeatedly visiting households and measuring the same indicators can increase the presence of soap at a handwashing location and apparent child hand cleanliness (Arnold et al. 2015). Also, how well the spot checks predict actual handwashing behaviour is not yet clear (Ram 2013). Self-reported knowledge questions, for example on the critical times for handwashing, are commonly included in surveys, although knowledge, like other proxies of behaviour, does not always correlate well with observation data (Biran et al. 2008). Nevertheless, the collection of both self-reported behaviour, as well as proxy measures for handwashing with soap remain an important data source in nationally representative and other programme surveys (such as UNICEF's Multiple Indicator Cluster Survey) (Ram 2013).

The choice of measurement approach depends on scale of the programme evaluated, as well as funding and logistical limitations; therefore no single indicator can be applied universally across programmes. Consistent use of an indicator may effectively indicate changes over time even if actual handwashing rates cannot be reliably determined. However, the possible effect on handwashing levels of multiple surveys investigating handhygiene must be kept in mind, as well as any simultaneous hygiene campaigns or health events (such as Global Handwashing Day).

1.5 Why is behaviour change so difficult to achieve and sustain?

Changing behaviour presents an ongoing challenge as it is influenced by many factors and is generally difficult to measure objectively. An intervention may be successful at changing determinants of behaviour, but these determinants may not be explicitly measured, the intervention may not run for sufficient time, or the evaluation may not be conducted long enough after the intervention for changes to take place. According to Aboud and Singla, strategies which form the basis of behaviour change interventions and programs need to utilise three sources: theories of behaviour change, evidence for the success and failure of past attempts, and an in-depth understanding of one's audience (Aboud et al. 2012). In particular, theories of behaviour change are being increasingly considered—since without understanding the drivers of hygiene behaviour we cannot develop strategies to change it. For example, an overview of 11 formative research studies showed that various motivators—including disgust, affiliation, status and attraction all played a role in handwashing (Curtis et al. 2009). Similarly, habit has been shown to be a key factor in handwashing practice (Aunger et al. 2010). Various behavioural models have been explored in different settings, two of which will be touched upon in the results of this review (Evo-Eco model and RANAS) (Mosler 2012; Aunger et al. 2014).

1.6 Methods

The question this review sets out to answer is the level of behaviour change which is possible in response to a successful hygiene intervention, to help inform programme design and monitoring. In addition, to determine which factors within each intervention may have contributed to a successful or sustainable intervention.

This study took the form of a rapid literature review, focussing on published peer-reviewed articles as well as programme reports and other grey literature on evidence of behaviour

change. The authors primarily reviewed mainstream research published from 2005 to date. The search included a range of databases (Medline, Embase, Scopus), as well as a review of programming reports from some of the key actors in behaviour change programming (The Global Public-Private Partnership for Handwashing, the World Bank WSP programme, UNICEF).

1.7 Inclusion criteria

In order to be included in the review, the manuscript or report needed to include information on an intervention to promote handwashing with soap, or an evaluation thereof, be delivered in a low or middle income country, be available in English and preferably have a behaviour outcome or a health outcome with considerable data on behaviour. As this document aims to outline interventions which have shown a positive impact on behaviour change, only successful studies—showing a positive change in behaviour—were included. No specific institution-based (such as schools, clinics) interventions were included, though some of the interventions may contain a school component.

Some of the successes are highlighted in case studies, providing a focus on particular factors within the case study which may have contributed to the results. That said, it is important to note that it is often hard to disentangle multiple component interventions to know which specific 'active ingredients' contribute the most to any measured success. If evaluations of hygiene promotion interventions include a comparison group and hypothesised determinants of behaviour are measured, then changes in key indicators can suggest that a particular determinant is part of the intervention mechanism of change. Additional handwashing with soap interventions that were unsuccessful in demonstrating a change in behaviour are thus not included while some other better-known approaches are only mentioned briefly. However, it should also be noted that there is a difference between lack of evidence for success and evidence for lack of success. In this review only studies which showed some evidence of success were included, though lessons from two 'lack of evidence for success' approaches have been highlighted.

Due to the nature of this 'rapid review', an exhaustive assessment of the all handwashing with soap literature was beyond the scope of this work. In addition, this review does not intend to produce a definitive list of factors that have automatically led to a successful intervention; instead it illustrates the factors which may have been important in these specific interventions. In all instances, understanding the target population through good formative research is paramount, and leading experts on behaviour change strongly advocate that it precede any intervention.

SECTION 2

Key findings

2.1 Included studies

Summary points

- Eight studies showing effective behaviour change and published in the last 10 years were identified.
- The majority of studies focussed primarily on handwashing with soap.
- Measures of sustainability of interventions are limited; one intervention showed sustained behaviour up to at least 45 days, and data from two interventions show that change in behaviour was sustained for at least 12 months. One intervention has been assessed after five years, and still shows evidence of the sustained behaviour.
- Overall, between 14%-67% increase in handwashing behaviour as measured by observation (sustained changes—45 day to 18 months) and between 4%-46% as measured by self-report (post intervention and continuous assessment).

2.2 Change in behaviour identified

All eight included interventions demonstrated increased handwashing with soap after a hygiene intervention:

- Biran et al. 2014 (India) – 15% change in observed handwashing at key events after 6 weeks, (19% in intervention versus 4% in control group) 31% change after 6 months (37% in intervention versus 6% in control group). The behaviour was sustained up to 12 months, at which point the control group had also received in the intervention and hands were washing at 29% of key events for both control and intervention.
- Huda et al. 2012 (Bangladesh) – 14% change in observed handwashing with soap frequency after cleaning a child in the intervention group (36% at 18 month follow up versus 22% at baseline). In the control group this change was 3% (37% at 18 month follow up versus 24% at baseline).
- Gautam et al. 2015 (Nepal) – 62% change in observed handwashing with soap before feeding a child, 45 days after the intervention (67% after intervention compared to 5% before the intervention). In the control group, the observed behaviour went from 7% at baseline, compared to 5% at follow up.
- Scott et al. 2008 (Ghana) – 30% change in reported handwashing with soap after visiting the toilet or cleaning a child's bottom, approximately three months after the intervention (as compared to reported handwashing with soap behaviour in unexposed group).
- Langford et al. 2013 (Nepal) – after the intervention, all mothers in the intervention group report washing hands after visiting the toilet and cleaning a baby's bottom (100% for both activities in intervention group, as compared to 90.7% handwashing after toilet use and 83.7% handwashing after cleaning a baby in the control group, resulting in a 4% and 19% change respectively). Data collected through continuous six-month evaluation.

- Bowen et al. 2013 (Pakistan) – intervention households were 3.4 times more likely than controls to have soap at their handwashing stations at study visit (97% in intervention households vs 28% at control households, resulting in a 69% change). Intervention households cited significantly more occasions for washing hands. Results collected 5 years after initial intervention.
- Galiani et al. 2012 (Peru) – 6% increase in caregivers knowledge on best ways to wash hands and an increase of 8% in terms of availability of water and soap for handwashing in intervention groups (as compared to baseline). In a subsample, 61% more households in the treatment group washed their hands with soap before eating (observed), as compared to the control group, four months after intervention.
- Contzen et al. 2015 (Ethiopia) –a 46% increase in availability of handwashing facilities (with water and soap) in the intervention arm receiving education and tippy-tap[2] construction training 6 months after the intervention, as compared to the baseline group receiving education only (83%versus 37%).

Overall, these successful interventions achieved between 14%-67% increase in handwashing behaviour as measured by observation (Huda et al. 2012; Biran et al. 2014; Gautam et al. 2015) and between 4%-46% as measured by self-report (Scott et al. 2008; Langford et al. 2013). Galiani, Contzen and Bowen also provided self-reported handwashing figures, but these changes could not be directly translated into a percentage change as presented above. However, Bowen et al. do report that mothers in intervention households were 14 times more likely to demonstrate good handwashing technique as compared to control households (7% of mothers in control households versus 97% of mothers in intervention households). In addition, intervention households report purchasing more soap compared to control households.

Of the eight included interventions, the settings, intervention strategies and follow up durations vary considerably, making it difficult to identify patterns for the factors contributing to their respective successes. Several studies provide evaluations of handwashing interventions—Scott et al. report on the evaluation of the National Handwashing Campaign in Ghana (Scott et al. 2008), Langford et al. evaluate a community based hygiene intervention in Nepal (Langford et al. 2013), and Galiani et al. evaluate a large-scale intervention in Peru (Galiani et al. 2012). In addition, Huda et al. provide an interim evaluation of an intervention in Bangladesh (Huda et al. 2012), Bowen et al. report on the longer term effects of an intervention implemented five years prior in Pakistan (Bowen et al. 2013) (the earlier evaluation and initial intervention effects are referred to as part of the same review (Luby S.P et al. 2006; Luby et al. 2009)). Contzen et al. provide data on a hand hygiene intervention in Ethiopia (Contzen et al. 2015), and Biran et al. report on results from an intervention in India (Biran et al. 2014). Additional information in the form of a process evaluation is available for this work (Rajaraman et al. 2014) and used in the interpretation of intervention effectiveness. Gautam et al. report on a food hygiene intervention in rural Nepal, of which handwashing with soap was a vital component (Gautam et al. 2015).

Most of the interventions (6 out of 8) focussed specifically on hand hygiene— Huda et al. evaluated hand hygiene as part of a larger approach including water and sanitation interventions and Gautam et al. evaluated hand hygiene as part of a food hygiene intervention. All but two of the interventions report on observed handwashing behaviour, with the remaining providing self-reported handwashing data. Three of the interventions also had a health outcome (Galiani et al. 2012; Huda et al. 2012; Langford et al. 2013). All of the interventions had some form of control group (where no, or a 'standard' intervention was implemented). The evaluation designs included cluster randomised control trials (n=4), cross

[2] A tippy-tap is a simple device for hand washing with running water. It can be made using a plastic container (such as a small jerry can). The container can be 'tipped' to allow the water to run out for handwashing, after which it is returned upright to save water.

sectional surveys with pre- and post- intervention measurements (n=2), a quasi-experiment with pre- and post-intervention measurements and a random experiment. The post-intervention follow-up time ranged from six weeks to five years, with one intervention providing continuous follow-up for six months (Langford et al. 2013).

2.3 Sustainability

The varying lengths of follow up make it difficult to draw conclusions about the longer-term sustainability of the changes in behaviour reported in the interventions. Bowen et al. report that previous evaluations of the handwashing with soap in the target population suggested that handwashing behaviours improved markedly during the intervention and were at least partially sustained for more than two additional years in the handwashing promotion group (Luby S.P et al. 2006; Luby et al. 2009; Bowen et al. 2013). In addition, Bowen et al. report that five years after the initial intervention, there was still evidence of increased handwashing with soap in the target community.

Galiani et al. report that the Global Scaling Up Handwashing Project in Peru aimed to generate and sustain handwashing with soap behaviour at critical junctures, but no further evaluation beyond completion of the intervention has been undertaken. Lastly, Biran et al. report that the SuperAmma intervention has shown to provide sustained behaviour change for at least 12 months. In this intervention specifically, six weeks post-intervention there was considerable variation in the outcome (range 5-61%), which reduced over time (Rajaraman et al. 2014). As a modified intervention was implemented in the control villages, it would be interesting to see if the effects observed after 12 month in control and intervention (both 29% handwashing with soap at key times) lasts equally long. Gautam et al. show that 45 days after the completion of the intervention, significantly more mothers in the intervention group wash their hands before feeding their child as compared to the control group. As this intervention reports the largest initial change in behaviour, it will be of specific interest to see how long this effect will be sustained. No information on this is available to date. Scott et al. report that despite seeing a change in hygiene behaviour, it is unclear if the effect can be sustained. The remaining three studies did not provide data on sustainability of the results (Huda et al. 2012; Langford et al. 2013; Contzen et al. 2015), though Contzen et al. did note that three months after the intervention, 83% of the households in the ‘infrastructure’ households had a functional tippy tap for handwashing.

Section 3 below highlights some of the factors which may have contributed to the success of these interventions. The results of the different interventions will be presented according to various sub-headings or determinants of behaviour change, including contextual, technological and psychosocial factors. These determinants have been adapted from various theories of behaviour change including the Evo-Eco model (Aunger et al. 2014) and the integrated behavioural model for water, sanitation and hygiene interventions (IBM-WASH) (Dreibelbis et al. 2013). All included studies are highlighted in the annotated bibliography at the end of this document, providing information on effect size, sample size and outcome measures.

SECTION 3

Handwashing determinants

This section discusses various factors or determinants which may have contributed to the success of the intervention. It also provides information on what was actually done as part of the intervention, and how handwashing was measured. In addition, several case studies are used to highlight specific factors which were relevant to a particular intervention.

3.1 Intervention

Summary points

- All interventions provided data on handwashing at key times.
- The majority of the included interventions measured handwashing through observation (n=7), with only one using only self-report. Most interventions used multiple methods.
- Spot checks of facilities and handwashing demonstrations were additional proxy measures used in some of the reviewed interventions.

3.1.1 How was handwashing measured?

Most of the interventions included used a variety of measures to determine handwashing behaviour in the study population. Structured observation (duration ranging from 3-5 hours) was used in all but one of the included studies—Bowen et al. only used proxy measures of handwashing. However, Bowen et al. did use direct observation of handwashing technique. Self-reported handwashing rates were collected through household questionnaires or in-depth interviews in all but two of the studies (Scott et al. 2008; Galiani et al. 2012; Huda et al. 2012; Langford et al. 2013; Contzen et al. 2015). Spot checks to determine availability of water, soap or a designated handwashing facility were done in three studies (Huda et al. 2012; Bowen et al. 2013; Contzen et al. 2015). As observed handwashing remains the best method by which to determine handwashing behaviour, the interventions using this method are considered to be of better methodological quality.

As additional measures of handwashing knowledge and practice, in the evaluation by Bowen et al. respondents were asked to free-list occasions during which they believed hands should be washed, and soap consumption was estimated for each household by dividing the reported numbers of bars of soap purchased by the household each month by the number of household members.

Contzen et al. used a script-based covert handwashing recall to provide an indication of handwashing at key moments—respondents were introduced to short sequences of daily routines representing handwashing key times, and they were asked to explain in as much detail as possible how they would proceed with this sequence.

3.1.2 Activities undertaken

Huda et al.

The intervention described by Huda et al. focussed on 11 key messages, including handwashing with soap before eating or handling food and after defecation or cleaning a child (see Case Study 1). In this setting, residents in the intervention group increased the frequency of handwashing with soap after cleaning a child's anus from 22% at baseline to 36% after 18 months. This was a significantly greater increase from the control group, where the handwashing frequency increased from 24% to 27% after the same time period. In addition, there was an increase in handwashing with soap post-defecation in the intervention group from 17% at baseline to 30% at 18 months. However, this increase was not significantly greater in the intervention as compared to the control group: 18% at baseline and 23% at follow up. This shows that attributing change to the intervention is difficult, and that using a control group can be essential to show if an improvement in handwashing behaviour is real. There was no significant difference in food related handwashing behaviour from baseline to 18 months in the intervention or control group. As all messages were delivered using the same approaches, it is unclear why some changed behaviour significantly, and other behaviours did not change at all.

Case Study 1 SHEWA-B showed a significant improvement in observed handwashing with soap after cleaning a child

Context
SHEWA-B is a large-scale 5 year water, sanitation and hygiene programme in Bangladesh targeting 20 million rural people. The programme engaged local residents to develop their own community action plans, which included targets for improvement in latrine coverage and usage, access to and use of arsenic-free water; and improved hygiene practices, especially handwashing with soap. The programme content and priorities changed considerably during the implementation period.

Delivery
Local residents trained as 'promotors' visited households, facilitated courtyard meetings and organised social mobilisation activities such as sanitation and hygiene fairs and village theatre, with the intention of reaching a mass audience of individuals.

'Active ingredient'
The messages alerted participants to the presence of unobservable 'germs' in the home environment, and practices which could minimise the impact on health, such as handwashing with soap.

Measured outcomes
Structured observation of handwashing practice was conducted as baseline in 2007 and repeated 18 months later. Similarly, at both time points a cross sectional study was conducted to collect data on household demographics as well as data on the households hygiene, water and sanitation status.

Strengths of this approach

- The study used matched intervention and control villages, with similar socio-demographic characteristics—this increases the likelihood that these improvements were due to the intervention.
- The community promotors were locally recruited and thus familiar to the communities—in addition to gaining prestige in the community, they were paid a modest salary.

- Control group was selected and enrolled in consultation with the Department of Public Health engineering of the Government of Bangladesh, who confirmed that no similar interventions were ongoing.

Contzen et al.
In Ethiopia, Contzen et al. tested two interventions in combination with a standard education intervention in different kebeles[3]. The interventions focussed on changes in self-reported handwashing, split into stool-related and food-related handwashing. An additional proxy indicator included the presence of a designated handwashing location and facility. At follow up, script-based covert handwashing recall was applied, where a respondent was provided with a short sequence of daily activities and asked to complete the routine. As the respondents were not asked explicitly about their handwashing behaviour, it was expected that social desirability in the response would be limited. Though observational data on handwashing behaviour was collected, data collection in the control arm (education only) had to be cut short, thus limiting the comparability in some groups.

The success of the intervention varied per intervention arm. For example, the two kebeles receiving infrastructure promotion (tippy-tap) were most likely to have handwashing stations in use, with soap and water present (83%) after three months. Observed stool-related handwashing and food-related handwashing rates varied considerably between the intervention arms and pre- and post- intervention which suggests that the outcome measure was unstable due to reactivity or poor outcome measurement. The low quality study design means that intervention impacts, although positive in general, need to be interpreted with caution.

Bowen et al.
The evaluation described by Bowen et al. focussed on self-reported handwashing behaviour of mothers in households who received handwashing promotion and soap during the intervention in 2003. Other measures of handwashing behaviour included demonstration of handwashing technique by the mothers, and self-reported soap purchases. The mothers in the intervention households were 14 times more likely to rub hands at least three times with soap and to lather hands for at least ten seconds as compared to mothers in control households. Households reported purchasing a mean of 0.65 (control), 0.91 (handwashing) and 1.1 (handwashing and water treatment) bars of soap/person/month. Case study 2 further focusses on which factors may have been successful in this study.

Case Study 2 Intensive interpersonal communication can lead to lasting behaviour change

Context
This cluster randomised controlled trial was conducted in 2003 (Luby S.P et al. 2006). Five study groups were included, two of which were randomly assigned to receive handwashing promotion with soap only, or handwashing promotion with soap as well as household water treatment (the remaining groups involved household water treatment, as well as a control). Follow up assessments of handwashing were done 18 months later (Luby et al. 2009) and 5 years later (Bowen et al. 2013).

Delivery
Fieldworkers arranged neighbourhood meetings, showed videos and provided pamphlets to illustrate health problems associated with hand contamination. In addition, the fieldworkers visited the households at least twice weekly for 9 months, where household members were encouraged to wet their hands, lather them completely with soap, and rub together for 45 seconds. Key times for handwashing were also highlighted. During these visits, field workers encouraged all persons in the household to wash hands with soap at key times, and soap

[3] Kebele- smallest administration unit in Ethiopia

was provided for the duration of the intervention. In control households, handwashing was neither encouraged nor discouraged.

'Active ingredient'

- Intense household communication, with provision of soap for handwashing and regular reminders to wash hands with soap, for nine months

Measured outcomes

- Self-reported handwashing (baseline only)
- Spot checks for handwashing facilities (all occasions, though varying information on soap/water availability)
- Demonstrations of handwashing technique (2005 and 2009 follow up only)
- Self-reported soap purchases (2005 and 2009 follow up only)
- Free listing of occasions during which hands should be washed (2009 follow up only)

Strengths of approach

- Short term efficacy study of handwashing in 2003: optimising handwashing practice
- Interpersonal communication during frequent household visits over several months

Gautam et al.
This intervention aimed to improve food hygiene behaviours amongst mothers of young children in rural Nepal, handwashing with soap being one of the key behaviours (Gautam et al. 2015). The food intervention was designed and tested using Behaviour Centred Design- a systematic Five step process to: A, Assess, B, Build, C, Create, D, Deliver and E, Evaluate the intervention. Outcome measurement was carried out approximately 45 days before and 45 days after completion of the three months' intervention. Handwashing with soap was measured through structured observation. Following the intervention, all mothers had heard of and participated in the campaign, compared with almost none in control cluster. Out of 12 expected exposures (two community events, four group events and six household visits) during the three-month campaign period, 90% of mothers were exposed at least ten times. All intervention group mothers were able to describe the five key behaviours that 'ideal mothers' should practice. In the intervention group, 67% of mothers washed their hands with soap before feeding a child, as compared to five percent at baseline (in the control cluster, this changed from 7% to 5% pre- and post-intervention). This intervention reported the highest change in handwashing with soap behaviour of all included studies. The follow up period is also the shortest, though a process evaluation has been planned to provide further information on the intervention.

Langford et al.
This intervention measured both self-reported (pre and post intervention) and observed handwashing behaviour (only pre-intervention) and contained a qualitative component to aid interpretation of findings (Langford et al. 2013). The intervention, based on the theory of planned behaviour, aimed to promote a positive attitude towards handwashing, establish handwashing as social norm and remove barriers which might hinder the practice such as the lack of perceived benefit of handwashing before handling food. The intervention was successful in changing a number of self-reported handwashing behaviours: in the intervention group 96% of mothers reported handwashing with soap after defecation (increased to 100% post intervention), 82% reported using soap after cleaning the baby's bottom (increased to 100% post intervention), with just a few using soap before cooking food (12% increased to 71%), feeding the baby (26% increased to 62%), or eating a meal (14% increased to 60%). It is possible that the intervention caused differential social desirability

bias and that this explains the differences between study arms. The intervention targeted social norms around hand-washing by emphasising the idea that this is what 'responsible' mothers do, but despite in-depth interviews post-intervention, it is not clear if social norms were changed. Barriers to good practice were tackled by the provision of soap during the intervention.

This study embedded ethnographic data into programme evaluation. The results show that while the intervention involved most of the women in the target area, changing handwashing behaviour was not a priority for the ultra-poor, as they have many other daily priorities. The authors report that this conflict made it more difficult to achieve behaviour change, and highlights a limitation of a social marketing approach alone.

Biran et al.
Biran et al. report that six weeks after the intervention, handwashing with soap at key events was more common in the intervention group than in the control group (19% versus 4%). At the six month follow up visit, this difference increased to 31% (37% versus 6%). After 12 months, the control villages had received the shortened intervention, resulting in the same handwashing with soap events in both groups (29%). The intervention increased soap use by all household members. This study included a process evaluation, which is discussed in case study 3 below.

Case Study 3 'SuperAmma' increases handwashing with soap in rural India—effect sustained for 12 months

Context
'SuperAmma' is a communication campaign based on the Evo-Eco theory of behaviour Change (Aunger et al. 2014). The model draws on evolutionary theory, psychology, and neuroscience to propose a systematic means of classifying the influences and drivers of human behaviour. The campaign was focused on a central character (SuperAmma)—an appealing, forward-thinking rural mother who had a loving, nurturing relationship with her son, teaching him good manners and ensuring that they both used soap for handwashing. It also featured a comical, male character whose disgusting habits were humorously contrasted with those of SuperAmma.

Delivery
The campaign consisted of various community-wide and school-based activities delivered over 4 days and subsequently over 2 days in a modified intervention designed to influence specific determinants of handwashing behaviour by inducing disgust, status and nurture motives, establishing social norms, instilling new handwashing habits and providing physical cues for behaviour. The promotion materials, including a short video, can be found on www.SuperAmma.org.

'Active ingredient'
The content of this intervention was based on the use of emotional drivers of behaviour change, such as disgust, nurture and affiliation. This was done through various means, including:

- Use of role models (i.e. village chairman endorsement by being photographed whilst handwashing with soap)
- Community event with screening of 'SuperAmma' animations, comic skit and pledging ceremony for women (aimed to target disgust, nurture and status motives)
- School based activities, such as group pledges, children parade, handwashing demonstration by teacher as role model)

Measured outcomes

The primary outcome measure was the proportion of key events when hands were observed to be washed with soap at all follow-up visits (6 weeks, 6 months and 12 months post-intervention). Secondary outcome measures include the proportion of observed handwashes which used soap and the total number of handwashes observed at all follow up visits.

In order to assess the overall implementation and effectiveness of the trial, a process evaluation was conducted (Rajaraman et al. 2014). Here the main outcomes were the acceptability of the intervention, the reach and the most effective approaches, measured through semi-structured interviews and questionnaire surveys.

Data from this process evaluation showed that:

- The intervention was acceptable to the communities and largely implemented as planned.
- Participation in community events on all three days was highest in villages with the greatest increase in handwashing with soap.
- Open ended questions in relation to 'why' hands should be washed with soap resulted in the following responses in line with intervention messaging: good manners (84% intervention versus 21% control), to be successful (30% versus 0%) and to protect children (63% versus 2%). Even though the intervention had not explicitly addressed health, prevention of disease was the most frequently cited reason (99% versus 48%).
- Normative beliefs about handwashing with soap were different between intervention and control villages. For example, in the intervention villages, respondents were more likely to report that 'almost everyone in this village washes hands with soap after defecation' (35% versus 8%)
- Respondents in intervention villages mentioned that parents should follow good habits of handwashing with soap and set an example for children (manners and nurture), that clean habits lead to success in life (success message) and that hands get contaminated by daily activities (disgust message).
- The handwashing with soap pledge was met with mixed responses, and Muslims were less likely to take the pledge, though were willing to listen and watch. This finding highlights the importance of pilot testing of acceptability and delivery strategy, especially if such an activity is transferred to a different setting.

Strengths of this approach

- Intervention based on influencing known and hypothesised determinants of behaviour using a theoretical framework for behaviour change.
- Delivery mode inspired by commercial practices—used a professional events management agency to deliver the intervention.
- Efforts made to target all mothers in intervention villages (additional neighbourhood pledges for mothers who could not attend other events, repeat screening of animations etc.).
- Observers were masked to the object of the study, (though may have become aware that the aim was handwashing). The second round of follow-up used a different team of observers to reduce potential for bias.
- Exposure to most of the different components of the intervention did not vary with socioeconomic status, demonstrating the ability of the intervention to cut across social divides within the targeted villages.
- The assessment of the intervention using a process evaluation was a vital part of the research strategy.

Galiani et al.
The handwashing campaigns and promotional events at the community level and one-to-one activities undertaken in the intervention by Galiani et al. in Peru seemed to have successfully transmitted the importance of handwashing with soap. Four measures of handwashing were included, namely observed and self-reported handwashing, spot checks of handwashing facilities and cleanliness of caretakers hands. The intervention messages reached 16% of the target population (one channel) or 34% for two communication channels. A six percent increase in caregivers' knowledge about the best way to wash hands was also reported. These improvements led to a statistically significant increase in self-reported handwashing. This improvement in knowledge led, in turn, to statistically significant behaviour changes in key areas, such as an eight percent increase in the availability of water and soap in the household, hand cleanliness, and observed and caregiver self-reported handwashing behaviour before eating, feeding a child, and preparing food. In addition, observed handwashing with soap only increased among the treated households by 61% before eating and by 69% before preparing food, as compared to the control groups.

Though no process evaluation was conducted to assess the most effective messages or communication channels used in the intervention, an assessment of reach was conducted. This is highlighted in case study 4 below.

Case Study 4 Global Scaling Up Handwashing Project in Peru—a large scale approach increasing handwashing behaviour

Context
The Global Scaling Up Handwashing Project in Peru was a large-scale intervention that aimed to generate and sustain handwashing with soap behaviour at key times among mothers, caregivers, and children up to 12 years old in rural households. The overall aim of the Project was to improve child health. The duration of the project was three years.

Delivery
The project consisted of two main components: a province-level mass media campaign, and a more comprehensive district–level community treatment, which also included handwashing promotion as part of primary school curricula. Activities were implemented by national, regional, and local governments. The Water and Sanitation Program (WSP) provided technical assistance, but the intervention was mainly conducted by public and private partners who integrated these activities into the governments' ongoing projects.

'Active ingredients'
A large number of activities were undertaken in the project—as no process evaluation has been conducted, it is difficult to state which activities were key in changing behaviour, and thus which may have been the 'active ingredients'. The main activities have been outlined below.

The mass media campaign at provincial level campaign:

- Emphasized the importance of the availability and use of soap for handwashing, and the need to wash hands with soap immediately before cooking or eating and after faecal contact (going to the bathroom and changing a baby).
- Radio spots were aired, lasting between 30-50 seconds 5-9 times daily.
- Print materials such as posters, comic books and brochures starring a superhero cartoon character (Super Jaboncin), were created and distributed.
- Street parades, games and local theatre were conducted in public places with the radio spot jingles as background music.

The community intervention was conducted at district level and consisted of the mass-media

(as described above) as well as:

- Training of trainers of community-based agents of change such as teachers, medical professionals, and community leaders
- Capacity building and provision of educational handwashing sessions (handwashing demonstrations) for mothers, caregivers, and children
- Handwashing curricula in select primary schools.

Measured outcomes
Specific to handwashing, the following outcomes were measured:

- Self-reported handwashing behaviour
- Observed handwashing behaviour
- Determinants of handwashing behaviour (knowledge, beliefs, and access to/placement of soap and water)
- Location of handwashing facility, presence of water, soap

Strengths of this approach

- Large scale intervention, assessing the effectiveness in a 'real world' setting
- The control and intervention groups were assessed for differences on a wide range of characteristics—some differences existed, but no clear pattern of differences was observed
- Measured attrition rate (drop out from trial) differences in the treatment and comparison group—none was detected
- Use of a wide range of actors and channels to emphasize messages
- Radio spots were played in three intervals (of approximately 4 months each)
- Strong political support at multiple levels and integration of intervention into on-going projects
- Study reports on intermediary outcomes, such as the campaigns effectiveness and behaviour change
- Increased reliability of handwashing data was collected through multiple measuring methods

Scott et al.
This evaluation in Ghana assessed the impact of different communication channels on reported handwashing behaviour of women in Ghana (Scott et al. 2008). Activities ran for 6 months and included promotion across three major communication channels (TV, radio, and community events). The campaign was evaluated using a structured questionnaire, covering issues of reach, message recall, interpretation and reported behaviour.

The evaluation reports that the handwashing campaign reached 82% of the target population. Overall, the TV and radio had greater reach and impact on reported handwashing than community events. As compared to the pre-campaign survey 89% of mothers reporting handwashing with soap after using the toilet (a 13% increase compared at baseline) and 55% washed hands before eating (compared to 14% at baseline) and 25% before feeding a child (compared to 6% baseline).

Lessons from other approaches

Two examples of approaches are presented to highlight some important principles. As noted above, these two approaches have not shown evidence for extensive success. Whether this is due to the approach, the setting, the timing or funding of the intervention cannot be determined with certainty.

1. PHAST (participatory hygiene and sanitation transformation) is a model used in a wide range of settings whereby communities solve their own hygiene problems with the assistance of trained facilitators. Unfortunately, there are no rigorously collected data available to support the effectiveness of PHAST programmes (Curtis et al. 2011). Bearing this in mind, a small scale pilot in Zimbabwe was designed with the aim of demonstrating the validity of the participatory approach to behaviour change. Community health club members' hygiene was significantly better than a control group across 17 measures of hygiene, including handwashing (Waterkeyn et al. 2005). In order to determine the potential success of this approach in different settings, further research in using PHAST would be beneficial.

2. A recent evaluation of a large-scale handwashing campaign in Vietnam did not show any change in observed handwashing at key times between the control and intervention groups [38]. This study was a cluster randomised controlled trial, assessing the impact on handwashing behaviour of both a mass-media campaign, as well as an interpersonal component (group meetings, festival activities, contests). Exposure to the campaign resulted in a slight increase in the availability of handwashing materials in the household and caregivers in the intervention group were more likely to report handwashing at key times (Chase et al. 2012). As no process data are reported it is difficult to draw lessons from this programme, which is unfortunate as so few handwashing interventions have been implemented and evaluated at this scale.

The extended use of the PHAST approach despite the lack of evidence on its effectiveness, the successful application of a PHAST-inspired strategy in Zimbabwe, and the inability to conclude on the reasons for the failure of the Vietnam intervention reinforce the need for rigorous impact and process evaluation, subsequent modification of intervention design, and further testing of 'new generation' interventions.

3.2 Individual Involvement, fidelity and reach

In three included interventions, household visits were an integral part of the intervention. Specifically, in the original handwashing intervention assessed by Bowen et al., households were visited at least twice a week for nine months. This intensive approach may have contributed to the lasting impact on behaviour change (see case study 2). Huda et al. also report regular household visits by promotors, but on a less intense scale (see case study 1) and households were also visited between intervention days in the SuperAmma trial. Gautam et al. report six door-to-door household visits following the community events.

Fidelity[4] was measured in two interventions—Contzen et al. report that activities were specified by detailed written instructions, but that despite this, especially in the intervention arms involving public commitments, there were deviations from the protocol. In the process evaluation of the SuperAmma trial, it is noted that after a few start-up problems, overall fidelity of the intervention was good (Rajaraman et al. 2014). A process evaluation is anticipated for the work in Nepal by Gautam et al. but is not yet available.

Reach of the intervention was measured in five of the interventions—Galiani et al. report intervention messages reached 16% of the target population (one channel) or 34% for two communication channels. The campaign evaluated by Scott et al. reached 82% of the target population—62% of women knew the campaign song, 44% were exposed to one channel and 36% were exposed to two or more channels. The intervention by Biran et al., as assessed in the process evaluation showed that in the intervention villages, 80% of respondents recalled a range of activities, including the animated films, skit, children's rally, posters and household visits. Langford et al. mention difficulty reaching the ultra-poor but no data is provided. Gautam et al. report that following the intervention, all mothers had heard of and participated in the campaign, compared with almost none in control cluster and that 90% of intervention mothers were exposed at least ten times.

3.3 Implementing partners

The studies were supported by various implementing partners. In most cases, these were local NGOs (Huda et al. 2012; Bowen et al. 2013; Contzen et al. 2015). Biran et al. used a professional events management agency (the facilitators were members of a street theatre troupe with experience of creation and delivery of performances relating to social issues)—the same delivery team was used throughout, consisting of the same members throughout the intervention. Similarly, Galiani et al. were supported by a local survey firm who conducted data collection together with a local institution specializing in nutrition. No implementing partners were reported by the remaining two studies (Scott et al. 2008; Langford et al. 2013).

3.4 Context and Technology

Summary points

- Water availability was limited in three of the eight included interventions.
- In two of the interventions, soap for handwashing was provided as part of the intervention (Langford et al., Bowen et al.), and in all the interventions soap use was mentioned. However, in half of the studies the availability of soap for handwashing prior to the intervention was noted (Galiani et al., Biran et al, Contzen et al., Gautam et al.) .
- One of the included studies provided assistance with handwashing infrastructure (tippy-tap construction). Provision of materials to construct a tippy tap, together with demonstration, can assist in improved access to a handwashing facility.

Water

One of the possible barriers to practicing good handwashing is access to water. As such, reliable access to water close to the dwelling may be an important factor in the success of a handwashing intervention. Relatively good access to water was reported in the studies by Biran et al. and Galiani et al. In rural India, villages included in the intervention had water supplied through hand-pumps or gravity-fed public standpipes—more than 80% of the

[4] Fidelity is the implementation of the intervention as it was intended [Steckler, A., & Linnan, L. (2002a). In A. Steckler & L. Linnan (Eds.), *Process evaluation for public health interventions and research* (pp. 1-24). San Francisco:Jossey-Bass}

households were within a few meters of a standpipe (Biran et al. 2014).Three-quarters of the households in the intervention in Peru had access to an improved water source[5], but no data was available on the location of the source to hypothesise how much water families would have had available for use (Galiani et al. 2012). Scott et al. reported that over half of the intervention households relied on public water pipes or hand dug wells as water supply, with the other half accessing water from within the dwelling.

Huda et al. did not provide information on water access or quantity available per capita per day. Water availability was reported to be limited in three studies (Bowen et al. 2013; Langford et al. 2013; Contzen et al. 2015)—for example, water availability in rural Ethiopia was limited due to extreme aridity and low water supply coverage—families' often only fetched 25 litres of water per day (Contzen et al. 2015).

Soap
Two studies provided soap as part of the intervention, which may have contributed to the success of the intervention in changing behaviour (Bowen et al. 2013; Langford et al. 2013). However, only Bowen et al. followed up to assess soap purchasing post-intervention, which was significantly higher intervention households as compared to control households. As such, the provision of soap during the nine month intense household contact at the start of the intervention may have contributed to a lasting 'habit' of using soap when washing hands.

Infrastructure
In Ethiopia, Contzen et al. provided a jerrycan with which to make a tippy tap in two of the 'infrastructure' intervention arms. At follow up (three months post intervention), significantly more households in the 'infrastructure' arm (only one cluster) had a designated place and facility for handwashing.

3.5 Psychosocial

Summary findings

- Handwashing reminders, such as stickers with eyes at the designated handwashing facility, can be used to prompt handwashing behaviour.
- Knowledge of key handwashing times, or good handwashing 'technique' does not necessarily translate into handwashing habit.

3.5.1 Pre-existing habits and habit formation

In all interventions, baseline levels of handwashing were low. As a result of this, the level of change that could be expected following an intervention could also be expected to be plateau at a relatively low level—especially if the adoption of new practices trickles through the population from a low initial rate. However, with relative low baseline levels, considerable improvements (in terms of percentage point change) could be expected following behaviour change intervention. Few of the reviewed studies explicitly stated pre-existing habits as formative research findings were not often reported—Contzen et al. report that handwashing in the study population was done using mugs or jugs. The authors also noted the lack of any handwashing infrastructure (i.e. handwashing stations) in the study households. In addition to providing an enabling environment, the presence of a handwashing station or soap can act as a reminder and thus cue handwashing (Curtis et al. 2009).

Only one of the studies provided handwashing stations such as a tippy-tap as part of the intervention (Contzen et al. 2015). However, the presence of a designated handwashing

[5] An improved water source can be piped water (into dwelling or yard/plot), a public tap or standpipe, a tubewell or borehole, a protected dug well or spring, or rainwater (as defined by the Joint Monitoring Programme, UNICEF/WHO 2014, www.wssinfo.org).

facility was reported in an additional three interventions (Galiani et al. 2012; Huda et al. 2012; Bowen et al. 2013), and water and soap availability at the designated handwashing station was noted in a total of three interventions (Galiani et al. 2012; Bowen et al. 2013; Contzen et al. 2015). Galiani et al. and Bowen et al. reported an increase in soap availability at the handwashing station as compared to baseline and Contzen et al. report 90%-96% increase in designated handwashing facilities as compared to baseline (in the two infrastructure arms).

Biran et al. distributed stickers with eyes on them to be kept at the handwashing location as a reminder to wash hands which may well have been a useful prompt while a new habit was developed. Gautam et al. also provided danglers as reminders to wash hands in the cooking area, and young children were provided with a bib with the text “did you wash your hands before feeding me” as a reminder or reward for handwashing with soap. Posters and other reminders were also developed by Galiani et al. and Langford et al., in addition to targeted videos and campaign songs/jingles. Biran et al. also concentrated on inserting handwashing into existing daily routines to further aid habit formation. The high frequency of visits to households in the Pakistan intervention may well have aided habit formation, although it is unlikely that such an approach would be feasible at scale.

3.5.2 Knowledge of key hygiene behaviours

Knowledge of handwashing at critical times can be a prerequisite for behaviour change, but having knowledge alone does not necessarily change behaviour. Knowledge may mean ‘knowing that handwashing is important’ or more specifically, knowledge that handwashing should be done at key junctures, such as after using the toilet.

Galiani et al. report a high baseline knowledge on handwashing with soap (knowing that using soap is best, and knowing key times for behaviour) with slight increases in knowledge following the intervention – this does not appear to be a key contributor to the success of this intervention. Another intervention which started with a high baseline level of knowledge of the critical times for handwashing was conducted by Langford et al. at baseline, self-reported handwashing rates were high (96% for handwashing with soap post-defecation).

Several of the interventions (Galiani et al. 2012; Bowen et al. 2013) focused on improving handwashing skills through the use of demonstration of correct technique. It is unlikely that demonstrating how to wash hands would increase self-efficacy and thus influence handwashing practices in these populations unless formative research or baseline surveys had shown that people did not wash hands because they struggled to know how to insert soap into their existing routines. The evaluated studies do not contain sufficient detail to comment on this further.

3.5.3 Social norms

From a review of 11 handwashing studies done in a wide-range of settings, beliefs about what other people are doing or what you think you should be doing (social norms) was shown to be a key motivation for handwashing (Curtis et al. 2011). As everyone tends to do what other people do, if a health behaviour is not practiced very frequently then the social norm keeps the behaviour at low levels (Bicchieri 2013). Four of the hygiene promotion programmes aimed to generate a handwashing norm by creating the impression that handwashing already was a social norm. For example, in the SuperAmma campaign norms were encouraged through a range of community activities including ‘handwashing with soap pledges’, posters of handwashing role models and announcements of the results of the household survey about handwashing levels in the village. The process evaluation explicitly measured changes in norms with respondents from intervention villages significantly more likely to respond favourably to statements about rates of post-defecation and before eating

handwashing in the village. This suggests that the intervention succeeded in creating the perception that others wash their hands with soap even if actual handwashing practices lagged behind, which may contribute to the higher rates of handwashing observed six months after the intervention than six weeks after.

Gautam et al. tried to generate a handwashing norm through competitions and pledging ceremonies. Reported beliefs on changing social norms after intervention increased considerably, for example, when asked if washing hands with soap before feeding a child is common in the village, the affirmative response increased from eight percent to 97% in the intervention villages.

In the intervention by Contzen et al. quantitative and qualitative results from the baseline study suggested targeting the descriptive and injunctive norms and barriers through various interventions. The public-commitment intervention seemed valuable because it was expected that committing publicly would increase the injunctive norm (beliefs about what you think other people think you should do) and that seeing others commit would enhance the descriptive norm (beliefs about what you think other people do). In addition, it was suggested that when the public commitment is delivered with a sign, (such as a scarf in this case) that the sign would not only prolong the commitment process but also serve as a reminder. The researchers' main idea of introducing a commitment sign was that people would express their commitment to the community by wearing the scarf so as to continuously trigger social norms. Unfortunately, slight variations in the message about the scarf created some confusion about when it needed to be worn, possibly reducing its effectiveness. In the 'tippy-tap' construction arm, as the handwashing-stations were constructed outside the house, using the handwashing-stations was expected to transform the traditionally privately performed handwashing behaviour into a publically-performed one, which was assumed to enhance the descriptive norm. Unfortunately no data was provided on the changes in norms which may have resulted from the intervention.

The intervention by Langford et al. reported to be effective at increasing handwashing with soap after faecal contact by making handwashing more 'visible' within the community, i.e. by using the normative hygiene expectation and the cultural imperative 'to be seen to be clean'. The authors conclude that the intervention was less effective at increasing hand-washing before contact with food because moral and social imperatives to wash hands were weaker. This was suggested as evidence that emphasising positive personal benefits alone was not effective in shifting behaviour.

Although the remaining studies did not aim to change handwashing behaviour using social norms it is possible that a shift in norms was an unintended intervention consequence.

3.6 Role of key people in the community

In Ethiopia, interventions were approved by the kebele (smallest administrative unit) leaders and elders, who explicitly endorsed participation (Contzen et al. 2015). In India, village chairmen were also visited to ensure endorsement (Biran et al. 2014). Although not explicitly stated in the other evaluation reports, all interventions would have needed to be acceptable to the community and ideally 'owned' by the community at large or championed by prominent members. In the intervention by Huda et al. in Bangladesh, the community motivators were financially compensated and the role was given a suggested to have a certain status in the community, both of which may have contributed to a motivated delivery of the intervention (Huda et al. 2012).

3.7 Underlying theories of behaviour change

Five of the eight studies provided information on the underlying theories of behaviour change on which the interventions were based. Biran et al. used the Evo-Eco model as a framework to guide the interpretation and analysis of the formative research (see case study 3 for further information on this model).The authors considered the physical and social environments, as well as the existing behavioural routines, together with human motivations such as nurture, disgust and status. Gautam et al. also based their intervention on the Evo-Eco model. Some of these similar motives were also explored by Scott et al. (disgust, nurture and social acceptance) in earlier work by the same research group. Langford et al. focussed on the psychosocial determinants of behaviour change, informed by the Theory of Planned Behaviour, but also considered 'motivated behaviours'[6] to create a demand for hygiene.

In the intervention by Contzen et al., the underlying theories of behaviour were based on the RANAS (Risk, Attitudes, Norms, Ability, Self-regulation) approach (Mosler 2012), which in itself incorporates various theories. The RANAS approaches takes into account that the key factors determining a behaviour may vary between populations, and as such Mosler (2012) suggest applying interventions that are not only theory- and evidence-based but also population tailored.

The three remaining studies did not discuss any underlying theories of behaviour change (Galiani et al. 2012; Huda et al. 2012; Bowen et al. 2013). Evidence suggests that interventions are much less likely to be successful if they are not theory-based (Aboud et al. 2012) so it is quite possible that these interventions were theory-based even though the theories used were not reported.

3.8 Overall implications and notes for programming

This rapid review provides information on several studies which have successfully changed behaviour in a variety of populations and settings, using a range of approaches and measures at various durations after intervention. The aim of this review was to provide information on the level of (sustained) behaviour change that could be expected following implementation of a successful hygiene promotion intervention.

The evidence presented here shows that current approaches to change handwashing behaviour can increase the level of observed handwashing with soap by 14%-67% and self-reported handwashing with soap at measured key times by 4%-46%.

However, we cannot directly compare these included interventions to draw out which approaches are best because the contexts are so very different. In addition, the interventions included measure a range of handwashing behaviours, for example after visiting a toilet or before eating—these different measures are likely to have varied effects of the levels of behaviour change observed, and thus makes direct comparison difficult. In addition, a focussed approach in seven villages (such as the SuperAmma intervention in India) is very different from a large-scale national programme (such as the intervention conducted in Peru). Overall, however, the results show that the greatest effects were seen in the smaller interventions and the smaller effects were in national programmes. The exact reasons for this are unclear.

6 'motivated behaviours' –behaviours that "occur in response to a need, or perceived discrepancy between as aspect of a person's current state and an ideal state"Aunger, R., Schmidt, W. P., et al. (2010). 'Three kinds of psychological determinants for hand-washing behaviour in Kenya.' *Social Science and Medicine* 703: 383-391.

Comparing the sustainability of these changes is also difficult, but studies have shown effects of this size can last between 45 days and 5 years at least. Due to the variation in intervention duration and follow up, it is difficult to assess which interventions were most sustainable. The longest follow-up, as reported by Bowen et al. (5 years) was in a study which did not specifically focus on handwashing with soap alone, but combined different approaches to reduce diarrhoea prevalence using a very intense household-focussed approach (Luby et al. 2006). The shortest follow up time (45 days) also showed the largest change in observed behaviour—67%, and an additional follow up moment would allow further evaluation of the sustainability of the change. The possible benefit of multiple timepoints has been shown by Biran et al., where the levels of change were measured at 6 weeks, 6 months and 12 months.

As the included interventions were very diverse it was difficult to identify cross-cutting themes in the aspects of these interventions that contributed to the effect. Additional factors which may affect the success of an intervention are specific settings in the target population—for example access to water, or general poverty levels, which may limit the change in handwashing behaviour which can be achieved. Overall, these included interventions show that it may be more difficult to change behaviours in some settings compared to others, and strong formative research is essential to understand and target the population. However, a range of determinants which may have contributed to the success of the individual interventions are discussed.

The majority of interventions included in this review considered underlying theories of behaviour change. This requires formative research to understand the current habits in the target community, which in turn allows for the intervention to be designed in such a way to influence specific determinants, and measure the expected changes in these determinants. In all future interventions, it is important to carefully consider the setting and which determinants of behaviour change may be important and can be measured. It is expected that it is these ‘active ingredients’, which are really developed to hone in on the routines and ‘gaps’ in the habit of the target population that help in success and sustainability. These approaches then take a less educational approach, and instead tackle the gap in behaviour from various angles.

Future handwashing programs and studies would benefit from some of the approaches taken in the interventions included in this review. However, it is important to note some key challenges: i) Intensive interventions in villages or communities would not prove feasible or cost-effective if they were to be delivered at scale and may not even ‘work’ at scale (e.g. Vietnam intervention (Chase et al. 2012); ii) Large-scale interventions may be full of richness and complexity which are unlikely to be captured in quantitative measures of intervention impacts, especially if intervention fidelity is low or variable. In these situations the evaluation may not justly reflect the intervention’s impact.

Overall, this area of research would benefit from for rigorous impact and process evaluation, subsequent modification of intervention design, and further testing of ‘new generation’ handwashing with soap interventions. In addition, evidence of cost would be beneficial, as this would help determine which successful interventions can also be implemented in a cost-effective manner.

Key factors which may contribute to success in behaviour change include baseline levels, follow up time post-intervention, and the exact handwashing times measured, in addition to a focussed intervention using various methodologies and approaches—carefully considered and grounded in behaviour change theory.

Annotated bibliography

Setting	Study design and size	Outcome measure	Intervention	Duration of follow up	Effect size/reach	External factors required for handwashing	Reference
Ghana (national)	Pre- and post-intervention cross-sectional survey Evaluation of campaign in a sample of 497 women	Handwashing: self-reported occasions when hands are washed with soap, using face-to-face questionnaires administered to mothers	Three major communication channels used: Television, radio and community events	One-time survey, 2-4 months after completion of the six month intervention	Compared to mothers not exposed to the intervention, 26% higher reported handwashing with soap. Compared to mothers not exposed, mother who were exposed to both the community even and the mass media were 33% more likely to report washing hands with soap after cleaning a child	None reported	Scott* et al. 2008
Bangladesh (rural)	Large scale cluster randomised controlled trial Structured observation in 1000 households, spot checks in 1700 households	Diarrhoea and respiratory disease Handwashing measures used: structured observation of handwashing with soap at key times Spot checks of WASH facilities	SHEWA-B intervention (aims to improve water, sanitation and hygiene for 20 million people in Bangladesh)	6 months and 18 months post-intervention	A 14% increase in handwashing with soap frequency after cleaning a child compared to control No significant difference observed in handwashing with soap associated with food (cooking, eating) or toilet use No effects were observed in health outcomes	None reported	Huda* et al. 2012
Pakistan (informal settlements	Cluster randomised controlled trial	Handwashing measures used: Soap and water	Original study in 2003: in areas assigned to soap	Initial follow up, a repeated follow up 18 months post-	Intervention households are 1.5 times more likely to have soap and water present at	None reported	Luby et al. 2009

Setting	Study design and size	Outcome measure	Intervention	Duration of follow up	Effect size/reach	External factors required for handwashing	Reference
)	577 households	availability at handwashing location and demonstrated handwashing	and handwashing promotion, neighbourhood meetings using slide shows, videos and pamphlets. Each household was visited at least twice weekly to encourage regular handwashing with soap and resupply soap	intervention	the designated handwashing place (79% versus 53%). However this effect was only evident in one of the intervention arms. Intervention households showed better handwashing technique as compared to controls. Note: Bowen et al. conducted an additional follow up on this study		
Ethiopia (rural)	Four-arm quasi experiment with pre-post design 462 households	Self-reported handwashing (either stool related or food related), structured observation of handwashing, covert handwashing recall and spot checks for presence of handwashing facility with water and soap	Four intervention arms: 1)'control' allocated to basic hygiene education 2) basic education and public commitment (pledge) 3) basic education and tippy-tap construction demonstration 4) All interventions	The interventions took place 6 months after the baseline, follow up was conducted 3 months after the intervention	Increase in the number of households reporting a designated handwashing place in the two handwashing infrastructure (tippy tap construction) groups. (96% increase in arm 3, 90% increase in arm 4). The mean rate of observed handwashing (stool related) was substantially higher at follow up as compared to baseline in the arms with infrastructure promotion.	Very low water availability, arid region	Contzen * et al. 2015

Setting	Study design and size	Outcome measure	Intervention	Duration of follow up	Effect size/reach	External factors required for handwashing	Reference
			(education, pledge, tippy tap)				
Peru (National)	Randomised experiment Baseline households: 3576 Structured observation in 600 households	Various child health outcomes (diarrhoea, acute respiratory infection etc.) Handwashing measured through: structured observation, spot checks of handwashing facilities in households, self-reported handwashing with soap, cleanliness of caregivers hands	Mass media campaign at provincial level, and mass-media with a community component at district-level This community-level intervention included several community and school activities	The follow up took place 4 months after the intervention activities finished	Mass media intervention alone had no significant effect on exposure to the handwashing promotion campaign messages, and thus no effect on handwashing knowledge or handwashing behaviour. The district level campaign was successful in reaching the target audience, improving the knowledge of the treated population on appropriate handwashing behaviour. Those improvements translated into higher self-reported and observed handwashing with soap at critical junctures.	None reported	Galiani* et al. 2012
India (rural)	Cluster-randomised controlled trial 14 Villages (7 intervention, 7 control), total 348 households	Observed handwashing with soap at key times	Community and school based events incorporating an animated film, skits, and public pledging ceremonies	6 weeks, 6 months and 1 year after 4-day intensive intervention	After six weeks: 15% difference in observed handwashing with soap at key times between intervention and control group (absolute increase from 1% to 19% in intervention group) After six months: 31% difference in observed	Soap was available in all houses, often kept on a shelf at the bathing place or on a windowsill	Biran* et al, 2014

Setting	Study design and size	Outcome measure	Intervention	Duration of follow up	Effect size/reach	External factors required for handwashing	Reference
					handwashing with soap at key times between intervention and control group (absolute increase to 37% in intervention group compared with 6% in control group) After one year handwashing with soap at key times was 29%, increased from 1% at baseline. Intervention reach: Campaign awareness reached 81% in intervention villages		
India (rural)	Cluster RCT	Handwashing with soap	See Biran et al, above	Process evaluation conducted 4-6 weeks after implementation			Rajaraman et al. 2014
Nepal (informal settlements)	Intervention 88 mother-infants pairs (43 control, 45 intervention)	Child diarrhoea morbidity rates Handwashing rates	Community based intervention, targeting mother-infant pairs Intervention mothers were visited once a day, then tapered off to once a week and were encouraged to wash hands at 5 key times.	Continuous evaluation for 6 months	The mothers in the intervention group were significantly more likely to wash hands with soap after cleaning a baby's bottom, before cooking, feeding the baby and eating as compared to the control group. In addition, reduced rates of child diarrhoea are reported in the intervention group as compared to control.	Limited water availability, soap provided for the duration of the study, each mother received 200 rupees (approx. £1.50 for participation)	Langford* et al. 2013

Setting	Study design and size	Outcome measure	Intervention	Duration of follow up	Effect size/reach	External factors required for handwashing	Reference
			Fortnightly mothers group meetings were facilitated. Additional activities included a 'handwashing song' and dance.				
Pakistan (informal settlement)	Cluster Randomised Controlled Trial 461 households	Handwashing was measured using the following methods: Direct observed handwashing technique, free-listing of hand washing occasions by respondent, observed handwashing place with soap and water, self-reported soap purchases	See Luby et al, above.	This follow up was conducted 5 years after the original intervention	Mothers in intervention arms more likely to list 'before cooking' and 'before eating' as occasions when they washed hands. No difference in reported HW after toilet – universally high. Cooking – 85% or 81% compared with controls 69% (increase of up to 16%) Eating – 49% or 52% compared with controls 30% (increase of up to 22%)	Approximately 65% of households in each arm received home municipal water supply	Bowen* et al. 2012
Nepal (rural)	Cluster Randomised controlled Trial 239 households (119 control, 120 intervention)	Handwashing with soap by mothers was measured through structured observation before feeding a child	A combination of community events (n=6) and door-to-door household visits (n=6) to improve five key food hygiene behaviours	Intervention duration: 3 months. Results measured 45 days after completion of the intervention	All key food hygiene behaviours increased in the intervention village, but handwashing with soap before feeding a child increased from 5% to 67% in the intervention villages	80% of the households (in both intervention and control) had soap available in the home.	Gautam* et al. 2015

(* indicates inclusion in review)

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